I - 1.5

Entry, Descent, and Landing Scenario for the Mars Exploration Rover

P.N. Desai [1], *W. Lee*[2]

(1) NASA Langley Research Center, Hampton, VA, USA
(2) Jet Propulsion Laboratory, California Institute of technology, 4800 Oak Grove Drive, Pasadena, CA 91109, U.S.A.

email: prasun.n.desai@nasa.gov

The Mars Exploration Rover (MER) mission's "Spirit" and "Opportunity" spacecrafts were successfully launched on June 10th and July 7th of 2003, respectively. The Landers are headed to the equatorial region of Mars with Spirit targeted to land in Gusev crater (14.59° S, 175.3° E) on January 4th 2004 and Opportunity to land in Meridiani Plains (1.98° S, 5.94° W) on January 25th 2004. Each Lander will carry a rover which will explore the surface of Mars making in-situ measurements. However, unlike the Mars Pathfinder Sojourner rover, these rovers are larger and more capable accommodating an increased suite of science instruments, and will be able to traverse greater distances during surface operations.

Both landers will deliver the rovers to the surface utilizing the same entry, descent, and landing scenario that was developed and successfully implemented by Mars Pathfinder. The spacecrafts will decelerate with the aid of an aeroshell, a supersonic parachute, RAD rockets, and air bags for safely landing on the surface (Fig. 1). However, MER the entry systems require modifications due to the specific mission differences of the MER mission. As compared to Mars Pathfinder, the entry mass will be higher. In addition, the local time of entry is later in the day (early afternoon) which will result in a lower atmospheric density profile. These two mission distinctions will have a major impact on the entry system design for overcoming the resulting higher terminal descent velocities.

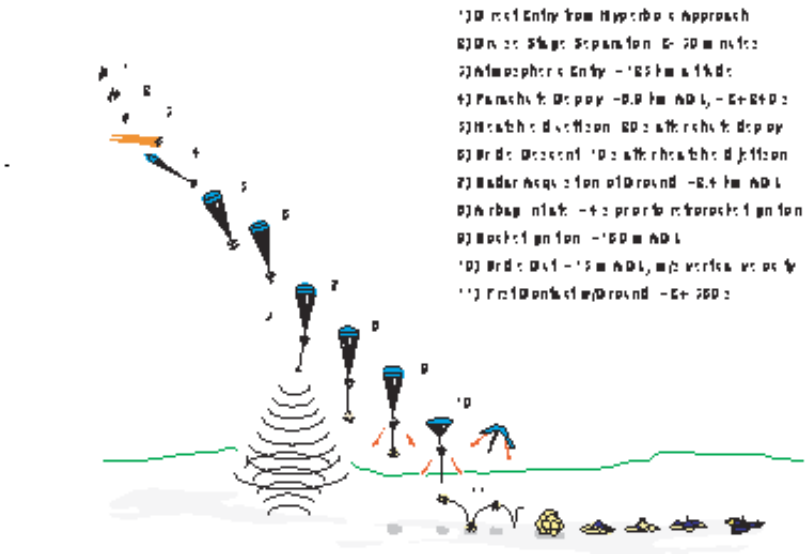

Figure 1. MER entry, descent, and landing sequence.

This paper describes the entry, descent, and landing system and the modifications necessary for the MER mission. The paper chronicles the specific challenges that had to be overcome in order to safely deliver the rovers to the surface. The sequence and the timing of the various events are presented that provide the most robust conditions for entry, descent, and landing.